ington and in answer to legitimate inquiries by mail.

Under these circumstances it seems that the facilities now offered by the Library of Congress meet the need indicated in Dr. Sumner's letter to a very considerable extent, and further advances in this direction will occur if it appears that valuable service can be rendered.

I conclude by inviting the readers of Science to make use of these new facilities whenever the library resources to which they have access are inadequate to the needs of the investigations which they have in hand. Communications should be addressed to the Librarian of Congress, and should be marked 'Science Section' if they are inquiries referring to the mathematical, physical or natural sciences.

J. David Thompson.

THE STORAGE OF MICROSCOPIC SLIDES.

To the Editor of Science: In your issue of December 30 you published an article by C. L. Marlatt, of the U. S. Department of Agriculture, describing a method of storing and indexing microscopic slides.

The Bausch and Lomb Optical Company have designed and are selling an excellent cabinet with card system which has all the advantages claimed by Mr. Marlatt for his and lacking only the envelopes, which I can not but think must be somewhat inconvenient.

These cabinets are made in three sizes, holding 500, 1,500 and 3,000 slides respectively. Tiers of trays, each running in its own groove, are constructed to take slides of various sizes. At the bottom are drawers (one, two or three) containing separate cards for every slide, on each of which is printed a form for registering the slide: Tray No.—Series No.—Name of Slide—Stain—Mounted in— and two lines for other data. There are also printed guide cards from A to Z.

The objects being recorded on separate cards, the removal of slides necessitates simply the removal of its corresponding card, while the addition of slides requires only the filling out and insertion of new cards. Classification thus, it will be seen, becomes exceedingly simple. The slides may be rearranged and the collection increased or diminished with the least possible amount of trouble.

Josephine Shatz.

Rochester, N. Y.,
January 8, 1905.

SPECIAL ARTICLES.

DOPPLER'S PRINCIPLE AND LIGHT-BEATS.

There is a beautiful lecture experiment in illustration of Doppler's principle due, I believe, to Koenig. A vibrating tuning fork of high pitch, say 2,000 vibrations per second, is moved to and fro near, and at right angles to, a reflecting wall. The waves coming from the fork and (virtually) from its image back of the wall are changed in length by the opposite motions of fork and image with the result that very audible beats are heard. With a fork of the pitch mentioned, a speed of three feet per second gives beats at the rate of about eleven per second. Although special forks are made for this experiment, they are quite unnecessary. An ordinary C 512 fork of Koenig's pattern gives a very shrill tone when strongly bowed near the shank and answers the purpose admirably. If the fork is held stationary and the reflecting surface is moved, the effect is the same on account of the motion of the fork's image.

Attempts to secure visible beats by means of light waves of slightly different wave-length have met with no success, partly on account of rapid changes of phase, and partly because of the difficulty of securing two sources whose vibration frequencies are nearly enough equal. Thus if we assume (what is most likely not true) that the failure to observe interference fringes with differences of path greater than, say, 30 cm. indicates a change of phase, this would indicate 10^9 or more changes of phase per second. On the other hand, should we take the two *D* lines as sources there would be about 10^{12} beats per second. It is evidently almost hopeless to attempt to secure visible light-beats in this manner. If we consider Doppler's effect, however, the case is quite otherwise. The second form of Koenig's experiment, viz., that in which the reflector is moved, is in principle almost exactly analogous to Professor Michelson's interferometer.

In this instrument the alternations in brightness at any point in the field when the slide is moved are beats due to the Doppler effect just as truly as are those heard in the second form of Koenig's experiment.

ALBERT B. PORTER.

CHICAGO,
January 14, 1905.

NOTE ON THE BROAD WHITE FISH.

IN the *Proceedings* of the American Philosophical Society of Philadelphia, XLIII., 1904, p. 451, plates VIII. and IX., I have wrongly identified the broad white fish, or *Coregonus kennicotti* Jordan and Gilbert, as the humpback, or *Coregonus nelsonii* Bean. My error was due largely to lack of material, ignorance of the species from autopsy, and the fact, as I have since discovered, that *C. nelsonii* does not always exhibit the well-developed hump like that of the type. Possibly when the Siberian forms are carefully studied the nomenclatures of these fishes will be more stable.

HENRY W. FOWLER.

ACADEMY OF NATURAL SCIENCES,
PHILADELPHIA, February 5, 1905.

RECENT ZOOPALEONTOLOGY.*

DURING the past thirteen years great advances have been made in our knowledge of the ancient mammalian life of North America, especially through the explorations in the Rocky Mountain region carried on by the Carnegie, Field Columbian and American Natural History Museums. The long Tertiary period has been clearly subdivided into a series of stages and substages. This enables paleontologists to record more accurately than ever before the time of arrival and departure of the larger and smaller quadrupeds from North and South America, Asia, Europe, Africa, and to determine more precisely when the connection of North and South America was interrupted by a gulf flowing between the Atlantic and Pacific Oceans, and when the connection was again made by the elevation of the Isthmus of Panama; this demonstrates also that a very much closer connection existed between the animal life of Europe and of North America through continuous intermigration over the broad land area now submerged beneath the Behring Straits. A series of six world maps prepared by Dr. W. D. Matthew clearly exhibit this submergence and emergence of the isthmuses between these great continents.

Of especial interest is the recent discovery by the Geological Survey of Egypt that the whole race of mastodons and elephants originated in Africa, entered Europe in the middle of the Tertiary and soon afterward found their way into North America and somewhat later into South America. We have now been able to fix very positively the date of actual arrival of these animals in North America. It appears probable that successive waves of migrations of European and Asiatic species of elephants and mammoths came to this country. In the meantime there survived here from one of the earliest African migrants the eastern American forest mastodon which lived until comparatively recent times.

The theory of multiple races or polyphyletic evolution not only of elephants but of horses, rhinoceroses, camels and titanotheres appears to be clearly established through these recent discoveries. It was formerly believed, for example, that the modern horse had a single line of ancestors extending back into the Eocene period; now it appears that in North America there were always four to six entirely different varieties of the horse family living contemporaneously, including slow-moving, forest-living horses with broader feet, and very swift plains-living horses with narrow feet fashioned more like the deer. Intermediate between these arose the variety which survived and gave rise to the true modern horse. Furthermore, it appears that the modern horses separated from the asses and zebras at a much more remote period than has been generally supposed, and we are now endeavoring to ascertain accurately when this separation occurred.

The same discovery of multiple races has been made among the rhinoceroses. In Eu-

* Abstract of a lecture delivered by Professor Osborn before the Society of Naturalists at the Philadelphia meeting.